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ABSTRACT

This paper presents a study that examined the effectiveness of a proposed teaching improvement process, referred to as practice-centered inquiry, by using faculty discussion groups involving a total of 29 professors, and formal classroom research studies, one of which is reported. The study, a collaborative effort by some of the professors in designing a formal classroom research project, is presented in two parts. The first part examines the effectiveness of a faculty discussion group to address the first two areas of the practice-centered inquiry continuum (i.e., ranging from casual observations to more sustained reflection and activity). The second part focuses on the formal research end of the practice-centered inquiry continuum. The results of the study are examined from two perspectives. One is from the perspective of the formal hypothesis, and the other is from the perspective of meeting the objectives of the professors. It is noted that the faculty discussion group structure was found to be appropriate in addressing the more informal levels of reflection and experimentation, and, while only a few classroom studies have been completed to date, the process appears to hold promise in contributing to the investigation of classroom teaching. Contains 27 references. (GLR)

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Practice-centered Inquiry: Developing Perceptions and Behaviors Toward More Effective Teaching in Higher Education

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Abstract

Faculty discussion groups and formal classroom research studies were developed to examine the concept of practice-centered inquiry, a proposed teaching improvement process. A total of twenty-nine professors participated in the four discussion groups described here. Some of those who participated in the discussion groups elected to collaborate in conducting formal studies in their courses; one such study is reported.

Introduction

A review of the research on the improvement of teaching in higher education, conducted nearly a decade ago, concluded that most of the reported findings "reflect only superficial levels of experience" (Levinson-Rose and Menges 1981, 419). For example, it was found that the most frequent measure of the effectiveness of workshops, the most common faculty development format, was participant satisfaction ratings. Much of the research reviewed focused on specific teaching techniques: how to develop a course outline; how to organize and present a lecture; how to construct a course exam. Generally, these techniques were taught and evaluated in isolation without any attempt to fit them into the wider context of the teaching-learning process or within the professor's existing knowledge of instruction.

The authors of the review found that research on the improvement of teaching in higher education did not represent a well-defined area of study, if judged on the basis of having a theoretical foundation and incorporating previous research in a systematic way. They viewed the exclusive use of quantitative methodologies to investigate questions about teaching and learning as insufficient. Rather, they recommended qualitative methodologies or a combination of approaches which would incorporate professors as co-researchers and not merely as subjects.

A survey of the research published in the decade since Levinson-Rose and Menges published their review indicates that most of the investigations of actual teaching improvement efforts

remain dominated by quantitative methodologies and generally still focus on specific teaching techniques or aptitudes. Characteristic of these investigations are those which compare methods of giving feedback from course evaluations (Wilson 1986; Tiberius, Sackin, Slingerland, Jubas, Bell and Matlow 1989); evaluate the effectiveness of teaching technique workshops through course evaluations (Wentzel 1987) or specific student behaviors in the classroom (Mahler and Benor 1984); or, analyze which teacher behaviors yield higher course evaluation ratings (Cranton and Hillgartner 1981). These studies offer a valuable contribution to the field, but they do little toward building a comprehensive understanding of the teaching and learning process in higher education.

In the last ten years, some attempts have been made to propose a theoretical framework for studying the process of teaching improvement in higher education. Kozma (1985) applied concepts from the study of innovation in complex organizations to instructional innovation in universities. A grounded theory of instructional innovation was then constructed based on the data from the analysis of four institutional projects. Two additional institutional projects which have been examined by another researcher corroborate these findings (Elrick 1990). Emerging patterns indicated that changing a teaching approach is a very personal process, one which is more likely to occur and continue if the change is perceived as meeting some identified need and if the change process is supported by peer group interaction. The most consistent finding indicated that new teaching behaviors

evolve from past practice. New practices are generally not considered and rejected based on their merit to enhance learning or to satisfy an identified learning need, but on their closeness to previous practice.

Another attempt to provide a theoretical framework for teaching improvement in higher education depicts the process of improvement as a developmental model. Four levels or stages are identified, each characterized by certain perceptions of teaching and learning and associated teaching practices. At the first and least developed stage, teaching is viewed by the instructor as telling; presenting information as facts. Development continues until, at the fourth stage, teaching has evolved into a "complex interaction of students, content and teacher actions" (Sherman, Armistead, Fowler, Barksdale and Reif 1987, 78-79). It is suggested that movement between the stages is encouraged by a number of considerations, including an opportunity for structured reflection, sufficient time to make shifts in thinking and action, considerable involvement, moderate levels of challenge and peer support and encouragement. This work, consistent with that described above, emphasizes the personal nature of instructional change.

Given the relative dearth of attention to theoretical issues in the study of teaching and learning in higher education, one cannot ignore the interesting theoretical developments at the elementary and secondary education levels. Of particular interest here is the area of research referred to as classroom processes and cognitive science research (Shulman 1986a).

Included in this area of research are the examination of classroom settings, classroom interactions, teacher cognition and decision making. More recently, the role of knowledge in learning has been investigated, primarily from the perspective of current cognitive theory which emphasizes the process of knowledge construction, the role of prior knowledge and the learning context (Resnick 1981; 1989). Perhaps most applicable to higher education, where professors generally think of themselves first as subject matter experts and researchers and then as teachers, is the proposed study of the relationship between teachers' subject matter understanding and their approaches to instruction. Three categories of teacher knowledge are distinguished: subject matter content knowledge, pedagogical content knowledge and curricular knowledge. Principal questions which have been suggested to frame the investigation in this area are: "What are the domains and categories of content knowledge in the minds of teachers? How, for example, are content knowledge and general pedagogical knowledge related? In which forms are the domains and categories of knowledge represented in the minds of teachers? What are promising ways of enhancing acquisition and development of such knowledge?" (Shulman 1986b, 9). These seem to be questions which could be equally appropriate in framing the investigation of teaching and learning in higher education.

In fact, in the last decade, there has been some attempt to explore these kinds of questions in the context of higher education. Examples are: descriptions of professors thought

processes concerning course planning and monitoring (Powell and Shanker 1982); the development of methods for exploring course content (Donald 1983); the examination of graduate teaching assistants' implicit theories of teaching and learning (Menges and Rando 1989); the evaluation of a mentoring project for new faculty (Boice and Turner 1989); and, an investigation of the relationship of professors' personal methods of research and knowledge development and their instructional methods (Shore, Pinker and Bates 1990).

The study described here seeks to contribute to this literature by examining the effectiveness of a proposed teaching improvement process which has been referred to as practice-centered inquiry (Van Note Chism and Sanders 1986) or as collaborative action teaching research (Schratz 1990). These proposed structures for teaching improvement are based on the premise that a large part of a professor's knowledge about teaching evolves from reflection and experimentation. The authors describe the practice-centered inquiry process as a "continuum of activities" (Van Note Chism and Sanders 1986, 58). At one end of the continuum are observations, realizations and questions that arise during the process of teaching or soon after. The center of the continuum is characterized by more sustained periods of reflection which may lead to a change in some aspect of one's teaching approach. At the other end of the continuum, practice-centered inquiry becomes formal research.

The study described here is presented in two parts. The first part examines the effectiveness of a faculty discussion

group to address the first two areas of the practice-centered inquiry continuum (i.e., ranging from casual observations to more sustained reflection and activity). The faculty discussion groups were designed to be consistent with both the emerging theoretical frameworks of teaching improvement in higher education and current cognitive science theories of learning and teaching. That is, they were designed to foster reflection and informal experimentation by professors in an interpersonal and intellectual atmosphere focusing on the relationship between subject matter content, the process of learning, pedagogical decisions and teaching behaviors.

The second part of this study focuses on the formal research end of the practice-centered inquiry continuum. Some of the professors who participated in the discussion groups chose to collaborate in the design of a formal classroom research project; one such study is described.

Faculty Discussion Groups

Each semester for the last two and a half years, faculty discussion groups focusing on teaching have been organized. Participation is voluntary and advertising is done through campus mail and the campus newspaper. Past participants have represented a variety of academic and professional departments including: Animal Science, Anthropology, Business Management, Chemistry, Economics, Educational Psychology, Family Medicine, Geography, Geology, Internal Medicine, Mathematics, Metallurgical Engineering, Nursing, Pharmacy, Physical and Occupational Therapy, Physiology, Political Science, and Psychiatry. The

groups have ranged in size from 6-12 participants with years of teaching experience ranging from one to twenty. A total of twenty-nine individuals participated in the four groups described here.

The discussion group participants decide how often they will meet. Three of the four groups described here chose to meet weekly for two hours over one semester. The fourth group met bi-weekly over the entire academic year. An effort is made to create an informal, comfortable setting for the discussions. This seems to be an important element as written comments from participants have made specific reference to the benefits of the "informal setting", "round-table arrangement", "optimal group size", "comfortable manner", "conduciveness to discussion" and "relaxed, yet constructive atmosphere".

The content of the discussion groups is based on information provided by participants. During the first meeting they are asked to fill out a form which addresses, among other things, their teaching experiences and the ideas or concerns they would like to discuss. Responses have ranged from questions about basic teaching procedures (e.g., "How to set and evaluate assignments"; "How to determine the goals and structure of my course") to complex teaching issues which present an on-going challenge for even the most successful instructor (e.g., "How to help students develop understanding and make links between theory and what they see in the lab or real life"; "not being able to get the students to understand what I have learned, digested and integrated over the years"). From these comments, a tentative

discussion agenda is developed by the discussion group leader and presented as a general direction for proceeding.

The following section describes the content of the discussions held by four groups over a two year period. Each group met for twelve to fourteen sessions. The description is taken from the notes of the first author, recorded after each session. The first author served as the discussion group leader for all four groups. Additional information was provided by the initial assessment of interest, a subjective evaluation of learning and participants' individual written evaluations completed at the last discussion session. The general discussion topics considered by all four groups included: 1) analysis of the subject matter; 2)analysis of the learning task; 3) matching of teaching methods and learning expectations; and, 4) evaluation of learning and teaching. Each of these will be discussed in turn.

Analysis of the Subject Matter

One of the first topics proposed for discussion was the structure of a professor's subject matter. Most of the discussion group participants had never thought about the structure of subject matter within their disciplines or in comparison to other disciplines. The knowledge structure, a method of "concept mapping," was introduced (See Figure 1). This method has been used to gather data about the structure of knowledge across disciplines (Donald 1983). In the discussion sessions, initial practice with the method was accomplished by working together to construct a knowledge structure for one of the courses being taught by a group member. For example, in one

group, a course from Animal Sciences concerning the function of food from a nutritional, social and political perspective provided an ideal practice possibility because of other participants' general familiarity and interest. Knowledge structures seem to have had general appeal, as evidenced by the fact that all discussion group participants constructed a knowledge structure for one of their own courses and explained it to their faculty discussion group in the following session.

The resulting sessions always created much interest. The opportunity to see the ways that others approached structuring their subject matter and reflecting their own knowledge proved fascinating. Some brainstormed all the concepts of the course and then narrowed them down to the major ones. Others went to their textbooks, course notes, course outlines, etc. before deciding on the major concepts. There was much discussion about the difference between topics and concepts and how to move from thinking about topics on a course outline to thinking about concepts that reflect the development of knowledge. All participants indicated that the process had required much thought. One professor discovered that he wanted to teach process rather than information, so his knowledge structure represented an analysis of a process which was then to be applied to various hunter-gatherer societies studied in his course.

Further discussion led to the advantages and disadvantages of sharing with students knowledge structures developed by professors. It was generally agreed that this would depend on the subject matter and the course level. One group brainstormed the

following list of reasons to consider sharing concept maps with students: 1) to provide a more specific idea of course content; 2) to provide a view of the professor's mental organization of the content and the course; 3) to provide an example of how one expert, after years of intellectual endeavour in this field, would represent the knowledge to be gained in the course; and 4) to provide an incentive for students to think about the course content in a cohesive, meaningful way. Another group felt that the students would also benefit from an explanation of why the professor was motivated to construct a knowledge structure, what was the process of constructing it, what impact it had on his or her own thinking and why he/she thought it beneficial to share with students.

Several of the participants did share their knowledge structures with their students soon after constructing them. Two of them reported that some students had been prompted to compare their own mental maps to that of the professor. For other students, it seemed to prompt an "Aha!" effect: "so that's how it fits together!" One professor described his students as seeming to be confused, but admitted he had provided very little explanation. Two of the professors reported that they had made changes in their knowledge structures based on the comments of their students.

Analysis of the Learning Task

The development of the knowledge structures which involved consideration of major course concepts and their interrelationships, easily led to a discussion of the kinds of

learning expectations professors held for students. The knowledge structure exercise was a clear demonstration to the professors that most of them expected much more from their students than simply the retention of information. The complex relationships between concepts indicated by their knowledge structures generally required more sophisticated levels of thinking and learning.

The Taxonomy of Learning Objectives: Cognitive Domain (Bloom 1956), was introduced to provide a vocabulary and structure for discussing different types of learning. The cognitive domain includes knowledge, described as the simple recall of information, and the higher cognitive skills of comprehension, application, analysis, synthesis and evaluation. Kemp (1985, 84) further described each of these levels using descriptive verbs. For example, verbs to describe analysis include: calculate, categorize, discriminate, and differentiate. One professor provided an example which illustrated the notion of higher cognitive skills in his course: He was pleased to note from his midterm exams that students had managed to retain the most important information from the lectures and the vast amount of required reading, but he was disappointed that there was not more evidence of either the integration of information from various sources or the ability to apply this in analyzing novel situations. He considered these abilities to be essential for anyone wishing to continue in his discipline of political science.

The taxonomy was not accepted by any of the groups at face value. The discussion always turned to whether or not one could discuss knowledge in this way and whether or not the categories really met the definition for a taxonomy, with skills listed in sequence of difficulty or sophistication. In addition to the cognitive domain of learning, the affective and psychomotor domains of learning were also introduced and discussed. These were of particular interest to those teaching in clinical areas, for example, in the fostering and evaluating of interpersonal skills, values and attitudes.

Participants were encouraged to use their knowledge structures to begin to articulate the learning they expected from their students. In all groups, there were some individuals for whom instructional or behavioral objectives held negative connotations. Many had been forced to write objectives out of context and according to a specific formula; the exact purpose of such an exercise had often been unclear to them. Some persisted with these negative attitudes and others decided there was some benefit in trying to clearly describe the expected learning. A total of fifteen of the twenty-nine participants in the four groups developed learning expectations based on their knowledge structures and presented them to their group for feedback.

Although the specific discussions varied considerably, in all groups over fifty percent of the meetings were spent in analyzing the subject matter and the expected learning. This included developing knowledge structures, discussing the notion of various types or levels of learning and determining learning

expectations. Several participants remarked that they had begun, for the first time, to look at teaching from the perspective of learning rather than as the organization and presentation of information.

Matching Teaching Methods and Learning Expectations

It was clear from the initial information collected from all participants that many had specific questions and anxieties about instructional methods and classroom formats (see Appendix 1). Some also stated that they were interested in innovative methods of teaching. One more senior mathematics professor stated that he had taught many different courses, both large and small, but he always taught them in the same way. Something about this made him feel uncomfortable, but he did not know what to do about it.

Instead of simply describing various teaching methods and practicing them, the idea was introduced of matching teaching methods to the specific subject matter and the expected learning. To begin discussion, two charts were handed out which organized teaching methods according to different kinds or levels of learning (Weston and Cranton 1986). In all groups, several minutes of silence followed as the participants reviewed these. Several stated that they had never thought of teaching in this way. Selecting instructional strategies to specifically support certain kinds of learning was a new perspective. Another commented that it was obvious that one could not learn to ride a bicycle, for example, with only a verbal explanation, but they had never thought about the function of "practice" in the improvement of intellectual skills such as analysis, synthesis,

and evaluation. In all the groups, a few people immediately jumped to discussing the possible mismatch between lecturing, the predominant teaching method in higher education, and the kinds of learning expectations we had discussed in earlier sessions. Others were skeptical of the general idea that teaching methods and level of learning were closely related. In an end-of-the semester evaluation, the following question was asked: We have discussed the notion of higher level cognitive learning (e.g., abilities of application, analysis, synthesis, evaluation, etc.). I am curious to know: 1) your thinking concerning whether teaching can facilitate this kind of learning, and 2) what place these ideas have in university level programs. The following is a sample of the responses

> There needs to be more focus on the teaching of thinking. Institutes of higher education are definitely the place for development of intellectual skills but there does not seem to be any conscious effort to consider it as a teaching issue.

> I think teaching can facilitate the development of these intellectual skills if a) the courses are designed such that esphasis is placed on these skills, and b) the students are initially made aware of the importance of these skills and that their (the students') progress will be evaluated on the basis of their ability to master them. These skills should

ideally be the central focus/overall goal of most disciplines.

There seems an urgent need to reconsider the role of the student and teacher in the university setting. Far too many courses still seem to treat students as nothing more than 'information-receptacles'. I am quite convinced that different teaching techniques can help a great deal to develop the intellectual skills mentioned - and at the same time develop the students' sense of confidence, initiative and responsibility.

To a certain extent but ..... students are primarily responsible for their learning at this level.

In discussing specific instructional strategies, familiar methods were addressed first, namely the lecture and lectures combined with discussion. Many were interested in using more discussion in their courses, but most felt uncomfortable with it. Some of the anxieties they described about conducting class discussion included:

- What if I ask a question and no one responds?
- What if someone asks a question I cannot answer?
- What if students get bored?
- What if one or two students dominate the discussion?
- I am worried that the discussion will not stay on topic.

- There is so much information to cover, I hate to take time for discussion.

Most participants thought of class discussion as the professor posing a question to the entire class or a student asking the professor a question in front of the entire group. A successful discussion was pictured as one in which everyone is listening and, one at a time, questions are asked and answered. The idea was introduced of dividing students into small groups for discussions and providing some structure depending on the instructional purpose for the discussion. This approach created interest, but most could not immediately picture themselves doing it.

One of the activities involved providing participants with short handouts describing various discussion methods and arrangements. After reading them, each participant made notes about how they might incorporate this method or arrangement into their courses or, if not, why not. Their notes were then discussed in pairs and each pair described their ideas to the full group. In each of the four faculty discussion groups, a few participants tried using at least one of these methods in their own course during that week and then returned to tell the group about it. Everyone seemed to become involved in discussing the possibilities of structured discussion in their courses, yet not everyone was convinced that they had the skills to do it.

An interesting observation at this point is that after several discussion sessions, participants became quite supportive of each other in terms of providing encouragement to experiment

with certain ideas in their courses. Often, the group came up with ideas about how to try something at a level one could be comfortable with.

Information about other instructional strategies (e.g., inquiry groups, peer critique, project methods, laboratory teaching, etc.) was handled in the same way: a) participants selected a short reading concerning an instructional strategy; b) participants explained the strategy to others; and, c) participants discussed the appropriateness of the strategy to their own teaching tasks. In this way, participants were presented with many ideas in a meaningful way and were provided with practice in selecting instructional strategies based on the structure of their subject matter and learning expectations.

Evaluation of Learning and Teaching

There are many issues surrounding exams and grading for most professors. All participants in these faculty discussion groups agreed that there was considerable faculty interchange regarding exams and grading, even though they frequently commented that they rarely, if ever, heard or participated in conversations about teaching problems and approaches.

Participants questioned whether the purpose of exams and assignments actually was the evaluation of learning. It was generally agreed that most professors viewed exams and assignments not as a way to evaluate learning, but rather as a way to separate out or rate students against one another. Poor exam scores, they thought, were hardly ever taken as an indication of poor teaching. If students did too well on an

exam, the test was seen as inadequate, but if students did poorly, then students had not prepared. According to participants, these views constitute the dominant attitudes of professors, in general. The discussions about exams and grading often seemed to dead-end and it was the participants who taught in clinical areas who usually pulled the discussion back to considering what type of learning was being evaluated. As one person from medicine stated: "We are acutely aware of the need to realistically evaluate knowledge and performance because we are educating future practitioners".

Interest was expressed about evaluation methods other than written exams. One person suggested that the problem with oral examinations was seen to be the loose organization, where neither students nor professors were really clear as to the purpose of the examination. In two of the groups, there were enough people from various medical programs to be able to create a separate group to discuss the evaluation of clinical skills, an area where written exams are plainly inappropriate. The discussion group leader provided them with a reference which addresses the construction and interpretation of appropriate evaluation methods (Evaluating Complex Student Learning, Cranton 1982).

Student problems concerning cheating and plagiarism were major concerns and, as one participant pointed out, perhaps larger than was justified considering the actual number of students involved. Others disagreed that the problem was that small.

It was clear from the discussions that many professors have an attitude of "me versus them" when thinking about examinations and assignments and less often view it as a true evaluation of expected learning. Many participants voiced the concern that sharing learning expectations with students and basing exams on them constitutes "spoon-feeding" and that too many students would do too well. Others countered with the idea that higher quality teaching should produce more learning overall but that there should still be a distribution of marks. As with most of the other discussions, no specific consensus was reached, but discussions were involving and provided a view of various perspectives.

Participant Evaluations of the Discussion Groups

Participants were asked to complete an end-of-the semester evaluation about the composition of the group and the structure and format of the sessions. Regarding group composition, all participants stated that there were advantages to having a multi-disciplinary group. One person stated that it was beneficial to "be able to identify with both the successes and failures of your peers." Another stated that "I also learned a lot about the startling differences in the subject matter demands in different faculties." A third commented that "I may not have felt as free to express myself if the group had been composed of only faculty from my own department." This comment may have some relationship to the frequent observation of several participants that faculty do not talk about teaching and questions about it are answered

very specifically without room for much conversation about teaching.

When asked to compare the structure and format of the discussion sessions with that of workshops, the responses were consistently in favour of the discussion format. Examples of some representative responses follow:

> A discussion group is better. I think that knowledge has to be explored and applied by the individual, and any more formalized or unified approach would probably tend to impose more of a common 'answer' to specific problems.

> I find the weekly discussion format more useful in that, in the long run, we probably cover more material than in a day long, or weekend workshop/seminar. Also, the material is easier to assimilate in smaller doses.

> The weekly group sessions are much better than a seminar. The exchange of ideas is uninhibited and personal rapport is fostered.

One person stated:

> Now that I know some of the questions, I would prefer to have a workshop directly focused on teaching techniques.

Twenty-five of the twenty-nine participants felt that the sessions had completely met their expectations. Two added they

would have liked to spend more time on evaluation methods. One wished more time had been spent on "problems we were facing in the classroom and how we were (or were not) solving them."

Another set of questions asked participants if they planned to change or adapt anything about their teaching and if they desired further support in doing so. Twenty-one of the twenty-nine participants stated they would use (or had already used) the knowledge structure method in planning courses and would like to experiment in using it with students. Sixteen planned to incorporate learning outcomes in the planning of their courses. Five were going to develop reading guides based on assigned readings and planned to use them as the basis for class discussion. Twenty-two planned to (or had already) experimented with various class discussion methods and the lecture/discussion combination method.

Thirteen of the twenty-nine participants wanted some kind of further support. Two of the professors continued to meet individually with the discussion group leader to plan new courses; another two to develop new course materials. Three participated in the faculty discussion group again during the next semester. Five wanted to attend a continuation support group. One borrowed more reading materials and two requested help in identifying highly rated professors in the university so that they could sit in on some of their classes. Five professors from one group were interested in getting more professors involved in the faculty discussion groups and wanted to remain involved themselves. Three of these individuals have made

presentations for the last two years at the annual orientation for new faculty. Plans are now being discussed to begin some kind of peer consultation/mentoring program.

Participants were also asked if they would be interested in collaboratively designing a formal study in one of their courses, based on changes they would like to make. Several have been interested in formal classroom research studies, but available resources have allowed only three studies to be completed and two more to be planned. These are discussed in the following section.

Formal Classroom Research Studies

Introduction

The design of each formal classroom research study is based on the questions and concerns of the professor. An initial interview is done to try to understand as completely as possible the context of the concerns expressed. The appropriateness of possible instructional interventions is then considered based on the match between the professor's questions and concerns and the comfortableness of the professor with implementing them. A literature review is then conducted to inform the design of the study and to see how a contribution can be made to the current literature. One of these studies is described in some detail in the following paragraphs.

The professor of the course, a participant in a faculty discussion group the previous year, had already implemented a few changes in the way he approached teaching. In this study, he was interested in addressing three areas he felt important in

teaching his large introductory course: 1) his own lack of enthusiasm in teaching a large (n=209) introductory course; 2) what he felt to be an "underuse" of his teaching assistants; and, 3) the level of learning evidenced by his students. The professor thought his lack of enthusiasm for teaching this particular course came both from feeling relatively isolated from the students and from having to lecture on information from the textbook instead of supplementary information which interested him more. He was using his teaching assistants only for grading. He had, in a previous semester, asked each teaching assistant to be responsible for one class lecture, but he had not been satisfied with the results. Finally, he was not happy with the level of learning he felt was being achieved by his students. He felt that they were not integrating information from various sources nor were they able to synthesize and apply the basic conceptual foundations of the course.

To address these concerns, it was decided that the format of the course would be changed to include one weekly tutorial or discussion section of about forty students each and only one, instead of two, large group lecture classes. Reading guides based on the textbooks were developed to guide students in finding and synthesizing the most important information in the readings. All students received the reading guides so that exposure to the text material would be equal for everyone. The reading guides formed the basis for discussion in the smaller discussion sections and the structure of the questions served to encourage the level of learning expected. They also freed the

professor from lecturing on the text material, thus allowing him to include more supplementary information. The tutorial sections were taught by the professor and the two graduate teaching assistants, providing both more individual student contact and a structured teaching situation for the teaching assistants. The professor participated in the development of all the instruments and activities, as he did in all facets of the study. He and the two graduate teaching assistants also participated in weekly research team meetings where problems, concerns and ideas were discussed.

Concept mapping was chosen as the experimental variable. Concept mapping is a visual representation of relevant concepts and the relations among them. Although the research on the effectiveness of this strategy is not yet conclusive, there is some evidence that its use in the university classroom can improve both the amount and level of learning accomplished (Okebukola and Judge 1988, Novak 1990; Mahler, Hoz, Fischl, Tovly and Lernau 1991). Based on the information from existing research, three treatment groups were established. These and other details are discussed in the following section.

Method

Sample. Undergraduate students (n=209) enrolled in an introductory Anthropology course offered in the Fall session of 1990 participated in this study. Results from a preliminary questionnaire administered to both students enrolled in the course one year prior to this study and to those who served as subjects in this study indicated that students in this course

tend to be homogeneous in age (mean age of 19 years) and in their second year of university. There are approximately equal numbers of males and females and most enroll in the course because of interest in the course content. Students represent a diversity of academic backgrounds. In the two semesters surveyed, eleven academic disciplines were represented. All students in the course were involved in the research study, as participation was an integral part of the course.

Instrumentation. Three instruments were developed and utilized: 1) a pre-post test of conceptual knowledge; 2) a demographic questionnaire; and, 3) an informal assessment of student attitudes about the effectiveness of various course components.

The test of conceptual knowledge was administered to all students during the first week of instruction and again during the last week of instruction. To construct the test of conceptual knowledge, a list of major concepts was compiled from the required readings for the course. The concepts were operationally defined as definitions, theories, sequences of procedures, or other units of information. To further refine the list, the professor of the course selected only those concepts he considered to be a reflection of the overall learning task and he added other concepts he felt were missing. This selection process continued until 30 concepts were selected as the most important or key course concepts. From the 30 key concepts, ten were randomly selected for each of 3 open-ended test forms. As a result of the random selection, most of the concepts appeared on

more than one form, while one or two were never selected. The three forms of the test were randomly distributed among students. There was, therefore, a random chance that students were given the same form of the conceptual knowledge test during the pre- and post-test administrations. Written instructions on each test requested students to define and explain the concepts to the best of their ability within twenty minutes.

The tests were scored by comparing each concept definition with the professor's. The scores ranged from zero (wrong or no response) to three (complete definition). In order to establish inter-scorer reliability, the two graduate teaching assistants for the course were asked to score ten tests randomly chosen from those collected. The agreement rate obtained in each case was 92%. In comparing the teaching assistants' scores to one another, an agreement rate of 99% was obtained.

In addition, concepts given a score of zero were analyzed descriptively. If an inaccurate explanation of the concept was given, it was marked as a misconception. The number of misconceptions was tallied for each subject.

A demographic questionnaire was administered at the beginning of the semester to gather information on sex, age, academic major, previous anthropology courses taken and years in university. The informal assessment of student attitudes was administered at the end of the semester.

Procedure

For one semester, students attended an hour-and-a-half lecture in a large lecture hall, and an hour-long discussion

session once a week in one of six smaller classroom settings. The discussion sections constituted the three treatment groups. In order to maintain an average number of 30 to 40 students in each discussion session, students were randomly assigned to the six sessions. Thus, each treatment group included two discussion sections.

The hypothesis of this study was that students with a more varied exposure to concept mapping would make greater gains in conceptual knowledge and exhibit fewer instances of misconception. All students were given the same basic reading guide that was developed to focus on the most important information in the two required textbooks. It was the inclusion of concept mapping activities in both the reading guide and the discussion sessions that distinguished the three treatment groups. Conditions for each treatment group are described as follows:

In the first group, students (n=57) were given a reading guide that providing them with questions and examples from the text material. In the second group, students (n=54) received the same reading guide but with the addition of concept mapping questions inserted at various points. These students were asked to construct concept maps to show their understanding of the interrelationships among important course concepts. No time was allotted during the hour long discussion session for discussion or feedback on their concept maps, but if students raised a question, it was answered by the instructor. In the third group, students (n=46) received the reading guide with the same inserted

concept mapping questions as group two, but for this group, time was allotted for students to discuss each others' concept maps in peer groups and to receive feedback from the instructor as time permitted.

A true control group was not established because the professor felt that all students should at least be introduced to the basics of concept mapping as a learning strategy. He therefore gave one lecture to all the students in the course. In this lecture, he explained the purpose of concept mapping as a learning strategy and suggested a procedure for creating concept maps. He then presented some examples.

The professor and two graduate teaching assistants were the instructors of the discussion sessions. Each taught two sections. In order to minimize the possible effects of teacher bias, the instructors rotated among groups every four weeks, adapting their teaching methods to the requirements of each of the three groups. This also had the benefit of providing an opportunity for the professor to form his own perceptions of the extent to which both the reading guides and the concept mapping activities motivated students and helped them to meet the learning expectations of the course.

Results

The analysis was based on the responses of 124 students from whom complete data sets were collected. Multivariate Analysis of Variance indicated that pre- and post-test scores were significantly different across all three groups ($F=153.66$, $p<.001$). The means and standard deviations of the pre- and post-

test scores for each group are presented in Table 1. Group three made the largest gains, followed by group two and group one, respectively. However, significant differences also appeared among pre-test scores, despite random assignment. There also appears to be a ceiling effect among the mean post-test scores for all groups.

Insert Table 1 and Figure 2 about here

The numbers of misconceptions on pre- and post-test scores were tallied for each group. Students in group three, who received the most varied exposure to concept mapping, showed the largest decrease in their percentage of misconceptions from pre- to post-testing, followed by students in groups two and one, respectively (Table 2). There were no significant differences on course exam scores for the three groups, either as analyzed by composite scores or broken down by objective and essay questions.

Insert Table 2 and Figure 3 about here

The analysis of the relationship between demographic variables and pre- and post-test scores of conceptual knowledge, analyzed using Multivariate Analysis of Variance, showed that older students had higher mean pre-test scores ($F=10.12$, $p<.05$), as did those who had taken previous course work in Anthropology ($F=4.46$, $p<.05$). No significant effects of sex, academic year or academic major were indicated ($p>.05$).

An analysis of the informal assessment of student attitudes indicated that 76% of the students found the reading guides either very helpful or quite helpful in understanding the textbook material. When asked how useful concept mapping was as a learning strategy, 38% of the students indicated that they had found it somewhat to very useful. To preserve anonymity, the attitude assessment could not be analyzed by treatment group.

Discussion

The results of this study must be discussed from two perspectives. One is from the perspective of the formal hypothesis and the other is from the perspective of meeting the objectives of the professor. Each will be discussed in turn.

Students significantly increased their conceptual knowledge from pre- to post-testing in all groups. The reading guide, common to all groups, was developed from the identified major course concepts and was designed to direct students to relevant text information. An effort was made to construct questions which required students to be able to apply knowledge to domain specific problems and to synthesize important information presented. The reading guides seemed to be readily received by students with 76% reporting them to be quite helpful or very helpful. The reading guides may have been sufficient to aid students with integration and synthesis of material and therefore lessened the effect of the concept mapping intervention. A closer examination of how to most effectively use reading guides to facilitate learning may prove to be an interesting investigation.

Post-test scores of conceptual knowledge indicated a ceiling effect. The type of test used to assess conceptual knowledge may have been limited in its ability to assess the depth and structure of a student's conceptual knowledge.

An analysis of student's misconceptions indicated that concept mapping may have aided students in correcting misconceptions. In group three, where students had the opportunity to discuss their concept maps with each other and the instructor, the percentage of corrected misconceptions was higher than in the other two groups.

Students were advised that they would not be graded on concept mapping questions, nor would they be asked to use them on an exam. Concept mapping was presented only as a potentially useful learning strategy. Yet, by far the majority of the students in the two concept mapping groups constructed maps each week, even though only those in group three had the opportunity to discuss their responses. This consistent completion of the concept maps suggests that students found them useful or interesting, or both, and that it is an appropriate instructional intervention for coursework at this level. Further investigation might pursue the usefulness of concept mapping in other content domains and include variables which focus on individual differences in the usefulness of this learning strategy.

From the perspective of meeting the objectives of the course professor, both personal views and continued practice were noted. The professor stated that he enjoyed lecturing on information of interest to him, instead of feeling bound to cover everything in

the textbooks. He also felt that he was a better lecturer, because he was more interested in the content. He was pleased to have more contact with students and enjoyed his role as discussion leader, although he felt he needed much improvement in this area. He was especially positive about the reading guides both in terms of coverage of textbook material and getting students to think about questions which required them to go beyond rote learning of information. He liked the notion of concept mapping and found that by incorporating it into his own thinking, he was better able to explain to his students the structure of his subject matter and some ways of thinking about it. He was continually surprised that so many students came to the tutorial sessions with reading guides prepared and concept maps completed or attempted. His evaluation of the teaching done by the graduate teaching assistants was also very positive. He felt this success was due to the structure and support they received from both the reading guides and the research team meetings.

The next time he taught the same course (Fall semester, 1991), he continued using the reading guides with inserted concept mapping questions. He wanted to continue with the discussion sections but was thwarted by the unavailability of classroom space.

Conclusions

The primary purpose of this study was to establish the effectiveness of the teaching improvement process referred to as practice-centered inquiry. Faculty discussions groups and formal

classroom research studies were the two methods used in this investigation. It was predicted that these methods would support the central premise of practice-centered inquiry, that a large part of a professor's knowledge about teaching evolves from reflection and experimentation.

The content of the faculty discussions and the number of professors who actually tried various teaching approaches suggest that the faculty discussion group structure was appropriate in addressing the more informal levels of reflection and experimentation. Participants were very positive about the discussion groups and were able to be quite specific in describing their learning. A more objective and comprehensive method of documenting the reflective process should be sought. Furthermore, the extent to which this informal reflection and experimentation fosters more permanent changes in thinking about teaching or in teaching practice has not yet been documented. Only a few individual classroom studies have been completed to date, but the process which has been established holds promise in contributing to the investigation of classroom teaching. These studies are also potentially valuable as case examples for others studying teaching and learning in higher education.

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Table 1

Mean Pre- and Post-test scores of Conceptual Knowledge by Treatment Level

Treatment	n	Test Scores	
		Pre	Post
Reading Guide	45		
M		6.15	12.63
SD		(3.53)	(5.62)
Reading Guide With Concept Mapping	36		
M		10.23	13.97
SD		(4.79)	(5.43)
Reading Guide with Concept Mapping and Immediate Feedback	43		
M		8.70	11.74
SD		(3.70)	(4.64)

Note: M represents Mean Scores
SD represents Standard Deviation

Table 2

Percentage of Misconceptions on Pre- and Post- tests
For Each Treatment Level

		Tests	
Treatment	n	Pre	Post
Reading Guide	45		
P		17.14%	14.49%
Reading Guide with Concept Mapping	36		
P		16.75%	12.25%
Reading Guide with Concept Mapping and Immediate Feedback	43		
P		19.17%	8.13%

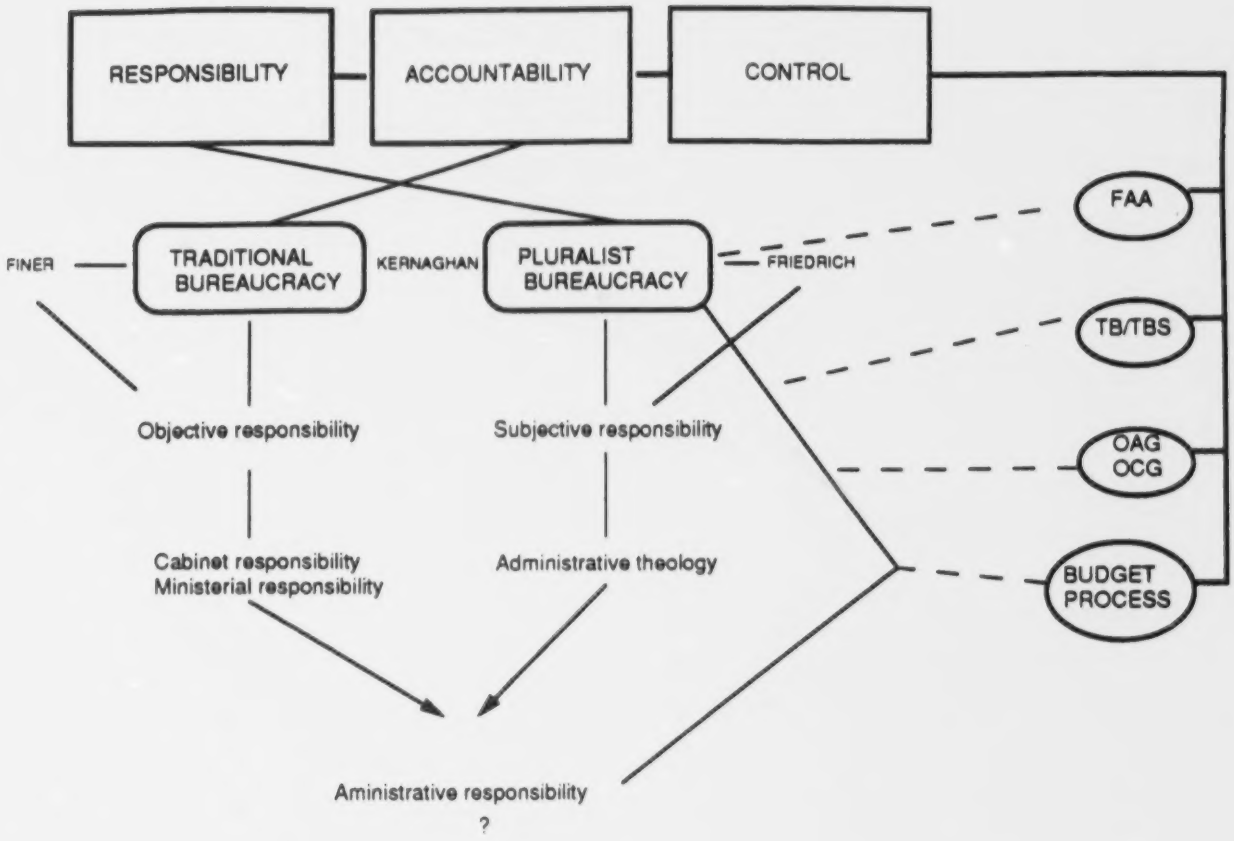

Figure 1. A concept map representing a Political Science Course

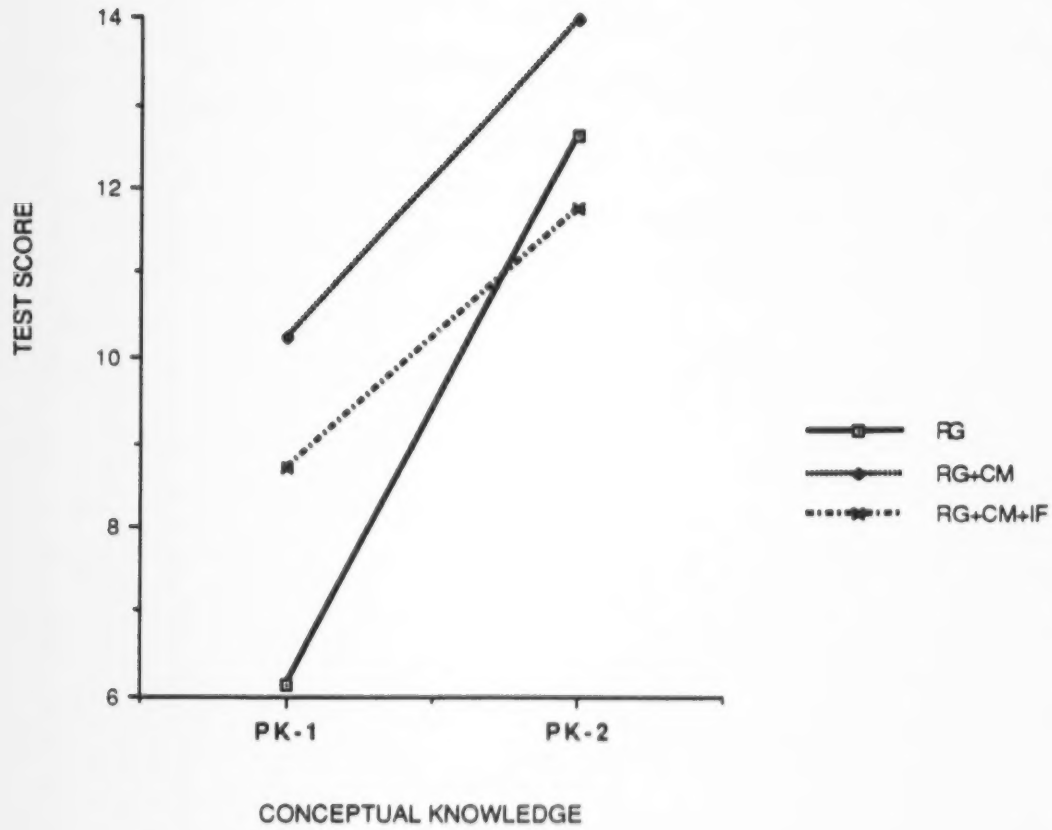

Figure 2. Pre- and post-test differences of conceptual knowledge.

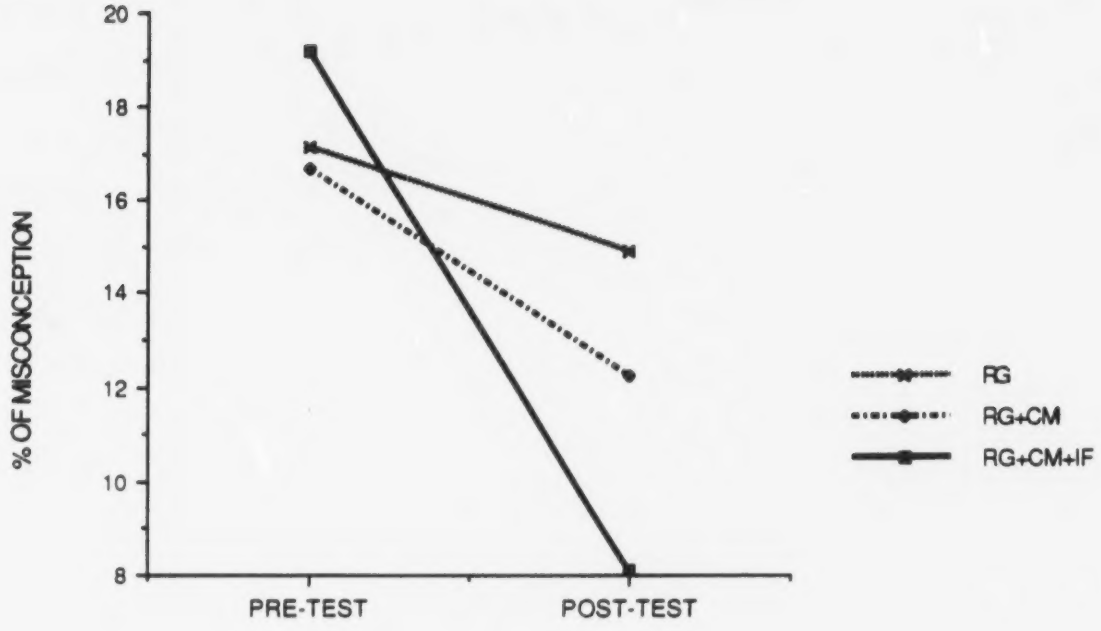

Figure 3. Pre- and post-test differences in percentage of misconceptions.